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The Refrigeration Service Engineer

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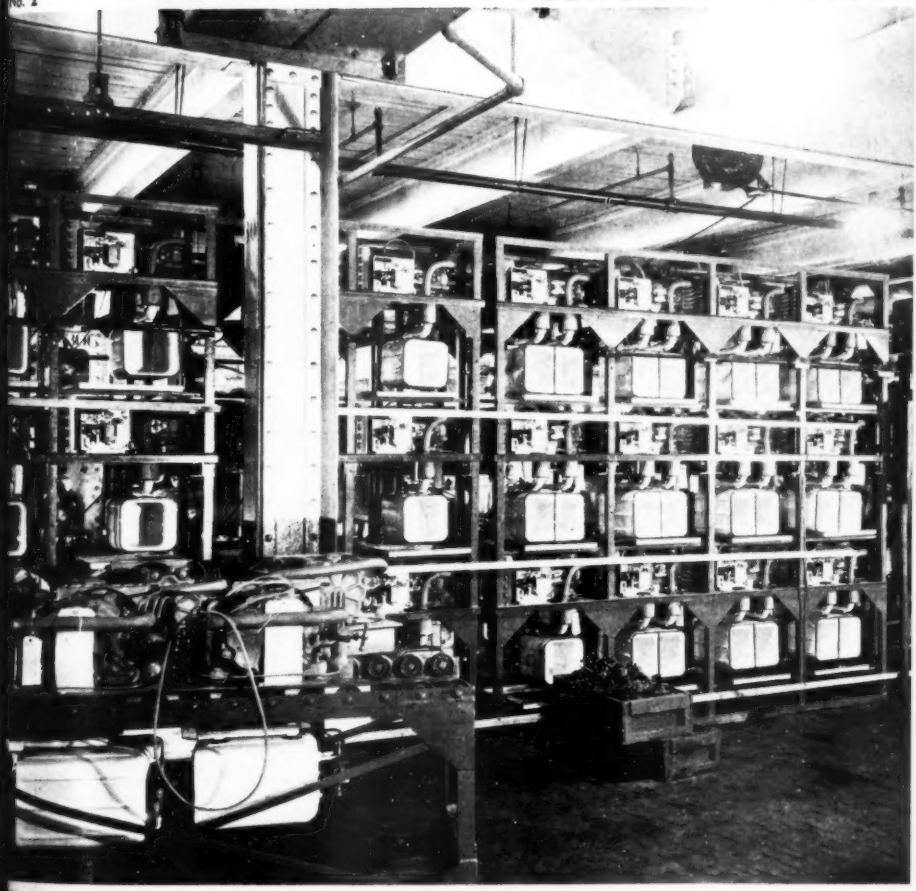

1935 Models Make Their Bow • Constant Pressure and Check Valves • Questions and Answers • Refrigeration Controls

The REFRIGERATION SERVICE ENGINEER

Devoted to the Servicing of
REFRIGERATION UNITS *and* OIL BURNERS

VOL. 3 FEBRUARY, 1935 NO. 2

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The Refrigeration Service Engineer

A Monthly Illustrated Journal Devoted to the Interests of the Refrigeration Service Engineer in the Servicing of Domestic and Small Commercial Refrigeration Systems and Oil Burners

OFFICIAL ORGAN REFRIGERATION SERVICE ENGINEERS' SOCIETY

VOL. 3, NO. 2 CHICAGO, FEBRUARY, 1935 $2.00 per Annum

New 1935 Models Make Their Bow

Refrigerator Manufacturers Anticipate Another Record Year, Refinements, Rather Than Radical Mechanical Changes Feature the 1935 Lines.

SIMILAR to the automobile builder, the refrigerator manufacturer formally presents the new 1935 refrigerators first to his distributors and sales organizations, and then through formal showings in dealers' display rooms.

This year's models, as in the past few years, emphasize new styling. With the public becoming more and more air-minded, streamlining is the style trend in many of the models.

Refinements in mechanical construction, of course, have been made, but on the whole, no radical mechanical changes have been made.

Additional conveniences for the housewife such as extra shelf space, freezing compartments and more storage space through the use of shelving and appliances on doors, have been adopted by most manufacturers.

Atwater-Kent Refrigerator

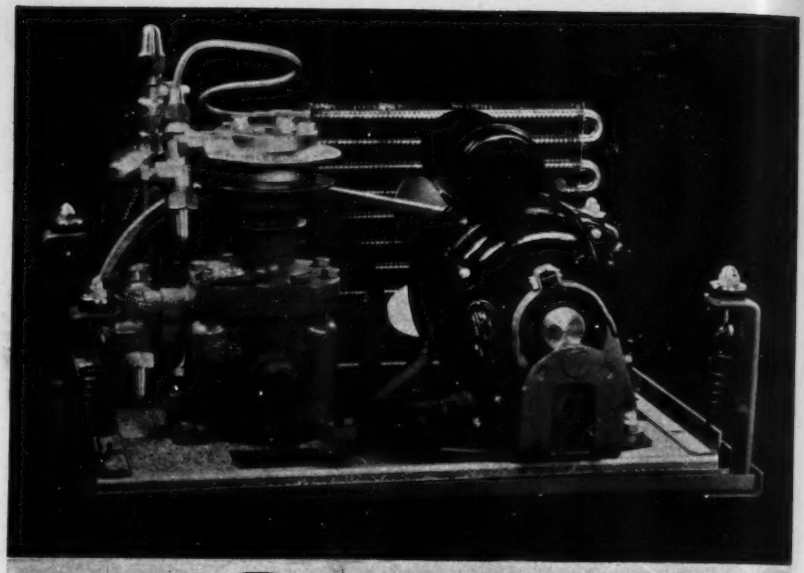
This refrigerator is made in four cabinet sizes ranging from 4.319 to 7.13 net cubic foot of storage space. Methyl chloride is the refrigerant and the same size compressor illustrated on page 4 is used in all models, and according to the manufacturer, tests have proved that this unit is capable of cycling at 130° temperature. It has an opposed thrust type of bearing with diaphragm seal. It has a twelve point temperature selector, plus a special "light duty position for vacation times."

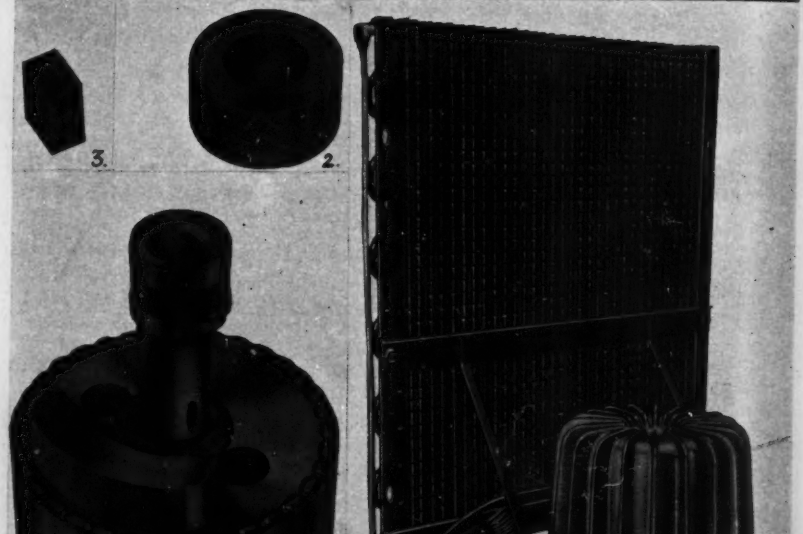
Fairbanks-Morse Conservador Refrigerator

The Fairbanks-Morse Conservador derives its name from a patented feature, consisting of an inner door which offers additional storage space without the necessity of opening the inner compartment of the refrigerator. The compressor has life-time lubrication. It is made in four models, ranging from 4.14 to 8.01 net cubic foot of storage space.

Crosley "Table Model" Shelvadors

Among the outstanding new developments introduced by Crosley at the mid-winter meeting of Crosley distributors held in Cincinnati early in January were the two "table type" Shelvador electric refrigerators that replace the old-type, open-top "chest models." Of two and three cubic feet storage capacity, respectively, their usable capacity





SEE DESCRIPTION ON PAGE OPPOSITE

is increased by approximately 50 per cent by the Shelvador feature..

Another new feature in these models is that both are equipped with a new type rotary compressor developed by Crosley engineers. "It has all the advantages of a hermetically sealed unit, with the added advantage that it can be serviced as readily as a belt-driven unit," said Powel Crosley, Jr., president, Crosley Radio Corporation. "Rotor with eccentric impeller and blade are the only moving parts. The liquid used is Thermon which is non-irritant, non-inflammable, non-corrosive and odorless. Operating with a partial vacuum, there is no leakage. Thermon will not break down and will maintain its efficiency indefinitely. It mixes with lubricating oil, thus insuring long life, and is approved by Underwriters' Laboratories.

"Greatly reduced tolerances feature the construction of the Crosley rotary compressor. Special machines had to be devised to insure tolerances of about one-tenth of those ordinarily prevailing. Micrometers will only measure a part accurately to within one-thousandth of an inch and are useless in the manufacture of Crosley rotary compressors with tolerances held within less than two 10-thousandths of an inch. These are the closest tolerances yet developed and cannot be approximated by individual operations in the finest model-making shops.

"To help visualize such small tolerances, an ordinary sheet of newspaper is two thousandths of an inch thick. The spaces between any two of the three moving parts of the Crosley rotary compressor are less than one-tenth the thickness of a piece of newspaper.

"These compressors are assembled in air-conditioned rooms which not only exclude all dust, but hold the moisture content of the air below the dew point to prevent any condensation on the parts which might cause corrosion."

PICTURES ILLUSTRATED ON OPPOSITE PAGE

Top. Refrigerating unit of the new Atwater Kent refrigerators which are just being introduced to the trade.

Lower. The three working parts of the new Crosley. *No. 1*—The eccentric or rotor shaft. The motor rotor is mounted permanently on the hardened steel eccentric. After mounting the rotor to the eccentric, this assembly is accurately counterbalanced, as lack of balance of the parts would be the only possible cause for vibration in the entire unit.

***No. 2*—The Impeller. The impeller, like the blade, is held to the extremely fine limits of one 10-thousandth of an inch in manufacturing. After the impellers are machined to these limits, they are first inspected for tool marks and burrs and for any tiny defects that might be apparent in their sides or ends. They are given a three way test for concentricity, bore and squareness. This means that the outside must be round, that the hole must be round and exactly at right angles to the sides, or to the faces and that it must be exactly in the center.**

***No. 3*—The Blade. This is the small rectangular shaped block that separates the high pressure from the low pressure within the compressor. The blade must be manufactured very accurately to work freely and maintain a seal between low and high pressure.**

All the advantages of a hermetically sealed unit, with the added advantage that it can be serviced as readily as a belt-driven unit. Rotor with eccentric impeller and blade are the only moving parts. Highly efficient—virtually sound-free. The liquid used is Thermon—non-irritant, non-toxic, non-inflammable, non-corrosive, odorless. Operates under partial vacuum in coils.

Kelvinator Announces 18 New Models

Refinement rather than radical change is the claim of the manufacturers of the 1935 Kelvinator refrigerators. The eighteen models are included in four groups—"K," "P," "D," and "SD" lines. The "K" line ranges in capacity from 4.25 to 7.60 cubic feet. The "P" line comprising three refrigerators, ranges in size from 5.41 to 7.60 cubic feet. The "D" line ranges in size from 5.13 to 8.73 cubic feet. The "SD," or super deluxe group comprises six models, ranging in size from 6.58 to 28.32 cubic feet.

Sparton Compressor

The new Sparton includes an antifrost electric clock, which will automatically defrost the unit, and is built in the top of the cabinet. It is set with two little knobs which appear on each side of the clock.

This year's compressor is a change from the direct drive, which formerly was located in the top, and is now the conventional reciprocating belt driven machine with the unit placed in the bottom. One of the important reasons for the change, according to Sparton officials, is that the new designs permit field servicing by independent service companies.

Mr. Harley Wall of the Refrigerator Department explained that the change was a

matter of service convenience; that in 1932, Sparton adopted a type of compressor which prevented any field service work, but where service was required, the compressor had to be exchanged. However, during the past two years, there has been a decided trend towards the adoption of the conventional type of compressor that would permit field servicing, and that this change was made because of the efficient service that could be secured from experienced refrigeration service organizations throughout the country. Previous to this change, Sparton had sensed the attitude of service men, and in 1934 had placed valves on their compressors, so that it was possible to do some servicing work, although to repair the compressor required the unit to be returned to the factory for overhauling, and in the meantime, a spare unit had to be installed during this factory servicing. The effect of placing the service valve on the 1934 models was carefully watched, and as a consequence, the adoption of the new conventional compressor.

The 1935 Sparton has forced speed lubrication, built-in oil separators, diamond bored and bearing sized cylinders, connecting rod and eccentric, lapped-in piston (no rings), guided bellow type seal, positive suction and discharge valves of Swedish steel, and noiseless fan. The dry expansion system as previously used, has been adopted for 1935 models.

Electrolux

Electrolux changes, of course, have been principally in their styling, and the entire Electrolux line is also designed so that kerosene can be substituted for gas, so that where gas is not available, such as on farms, villages, suburban homes, summer cottages, mountain lodges, roadside stands and other locations, the Electrolux can be used.

Stewart-Warner Compressor

Stewart-Warner's compressor this year will be a single cylinder, but according to the manufacturer, is no radical change from the twin-cylinder of last year.

Norge Compressor

Some refinements have been made in the Norge design this year, and mechanical changes include an inertia pulley on the motor shaft, which tends to slow down the initial starting and to eliminate any light flickering. The motor is also mounted somewhat differently from last year's model. The motor pivot is placed at one side nearer the compressor, which is designed to make the pulley tighter by the motor's own torque when the compressor starts. Lessening noise has also received consideration, such as caused by the motor starting switch and two double blade springs have been placed in the compressor to minimize noise of blade.

The Leonard Refrigerator

Its lowest-priced classifications incorporating a host of deluxe features and its higher-priced groups generously refined, Leonard Refrigerator Co. has announced the 12 new models that comprise its 1935 line.

Six porcelain and six lacquer-finished models are included. Food storage capacities, which are indicated by the figures in the model designations, range from 10.59 cu. ft. in the PD1059 to 4.25 cu. ft. in the LA "leader" cabinet.

A model confidently expected to account for a large number of 1935 Leonard sales is the LD553. This model is lacquer-finished with important deluxe features. It has improved leg and base construction and a redesigned machine compartment.

Additional ice capacity is found in the 1935 SP600 and SL600. Construction features and dimensions of these models are identical, with the exception that the SP600 has a porcelain exterior and the SL is lacquer-finished. The four-tray cooling unit produces nine pounds of ice—84 cubes. The same ice capacity exists in the larger SL721, a lacquer-finished model. Like the PD and LD lines, each of these three Leonards has a refrigerated shelf in the cooling unit.

Gibson Refrigerator

One of the principal changes in the Gibson this year is the "Freez'r-shelf," or flat evaporator. The "Freez'r-shelf" extends all the way across the width of the cabinet interior at the top.

The cube capacity has been increased—the smallest model in the new line freezing eleven pounds at one freezing, and the largest model, fifteen pounds.

The Uses of the Constant Pressure and Check Valves

By JOE ASKIN *

Constant Pressure Valves maintain desired Pressures in the Evaporator within a Few Ounces. Check Valves assure Positive one Way Flow of the Refrigerant

THE constant pressure valve and check valve are coming into more general use as the development of refrigeration continues. The owner of a refrigerated walk-in cooler, for instance, can see no reason why the compressor down in his basement should not operate another bit of refrigeration equipment. He knows that the machine in his basement is not running all of the time—that it has reserve capacity, and when he is ready for other equipment he wants to use this same compressor if possible. He likes the idea of a central power plant similar to his central steam plant (the furnace), which is used to heat all of his rooms. He wants to save money on the installation, and so he asks for an estimate on the contemplated change, without appreciating fully the difficulties which the service engineer may encounter in making the changeover.

It is to simplify and aid installation such as these that the Constant Pressure Valve, Two-Temperature Valve and Check Valve were developed.

The valves are not only used in changing over old equipment, but also in new multiple installations as well as for many special uses mentioned below.

Many service men and installation men use these valves if for no other reason than as *insurance* against "something going wrong," thus reducing the number of service calls. For example, you may use a check valve between the discharge shut-off valve of the compressor and the condenser. This is illustrated in Fig. 1. This has been done as insurance against the compressor discharge valves leaking, which would ordinarily cause short-cycling. To make this installation would require that a shut-off valve be placed on the receiver near the outlet from the condenser or that the refrigerant be removed from the condensing unit.

Another special use is to place a Constant Pressure Valve at the outlet of the evaporator on a single coil system. This again is done for the sake of insuring the job against "something going wrong," such as a change in pressure control setting. This valve is

CONSTANT PRESSURE VALVE

placed in the system at extra expense for a single unit installation and yet many service men are recommending this whenever permanency is of greater importance than first cost.

And now for some of the more general uses of these valves:

Figure 2 shows a beer or water coil immersed in a sweet water bath. A Constant Pressure Valve will maintain a constant thickness of ice around the coils. It is easy to change the setting of this valve to take

* Chief Engineer Refrigeration Division, Fedders Mfg. Co.

care of changes due to the weather, the load on the system, or any other changes which may affect the amount of ice stored around the coils. This beer coil installation may be connected in multiple with an ice cream cabinet. The ice cream cabinet, being at a lower temperature, operates on a cycle depending upon the setting of the pressure control—for example, with methyl chloride refrigerant the setting would be zero lbs. cut-out and 6 lbs.

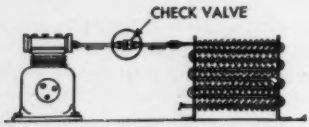


FIGURE 1

cut-in. The sweet water bath beer cooler would be taken care of by setting the Snap Action Valve to snap open at 19 lbs., and snap shut at 11 lbs. If a Constant Pressure Valve were used it would be set at 15 lbs. gage—maintaining a constant pressure at all times. Should a greater amount of ice storage around the coils be desired, a twist of the adjustment screw to give a slightly lower back pressure would give the desired result. Figure 3 shows a multiple hook-up composed of four different types of coils connected to the same compressor and maintaining four different temperature conditions.

The check valve is installed on the suction side in order to keep the high temperature gas from blowing through the Constant Pressure Valve or Two-Temperature Valve and entering the low temperature (and low pressure) coil. A Check Valve should be installed at the outlet of the low temperature evaporators and a Two-Temperature Valve or Constant Pressure Valve at the outlet of the higher temperature evaporators. In other words, a check valve should be omitted from the highest temperature lowside, placing check valves at the outlet of all other lowsides and a Two-Temperature Valve or Constant Pressure Valve should be omitted from the lowest temperature lowside and placed at the outlet of all of the other lowsides.

Figure 4 shows another typical installation of these valves.

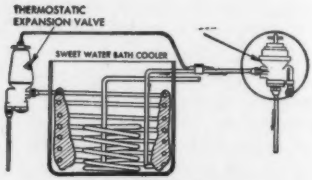


FIGURE 2

Several multiple hook-up combinations in common use are as follows:

1. Beer coil, refrigerator, and ice cube maker.

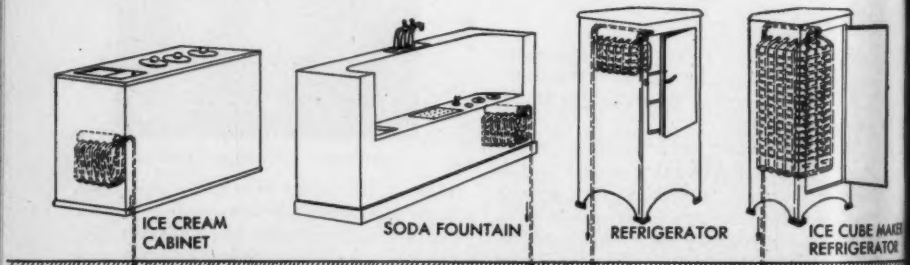
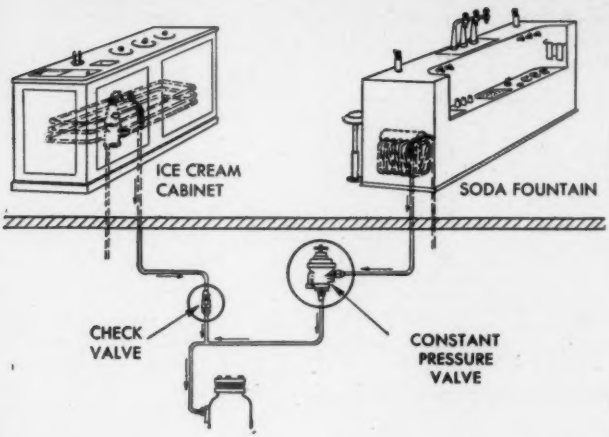


FIGURE 3



2. Sweet water bath, soda fountain and ice cream cabinet.
3. Walk-in cooler, show case and butter chest.
4. Milk cooler, aerator and walk-in cooler.
5. Milk storage room and ice cream hardening room.
6. Forcedraft unit cooler and sweet water bath used for cooling beer.
7. Back bar coil and sweet water bath beer cooler.
8. Beer coil and forcedraft unit cooler.
9. Beer coil and non-frost evaporator.
10. Beer coil and ice cube maker.

FRIGIDAIRE SERVICE MANAGERS HOLD ANNUAL CONVENTION

SIXTY district installation and service managers of Frigidaire Corporation held their annual convention in Dayton, Wednesday to Saturday inclusive, January 16 to 19. The sessions were held at the Miami and Biltmore Hotels, and the Wednesday session was a joint meeting with the distributing organization heads, which included a dress rehearsal of the 1935 Frigidaire convention for salesmen and dealers.

All sections of the United States were represented, and the service managers attending have jurisdiction over the installation and service operations involving all of Frigidaire household and commercial refrigerating equipment and air conditioning systems and units.

Mr. Roy E. Smithson, National Installation and Service Manager, presided, and the speakers and those leading the discussions included V. A. Hetzel, Assistant Installation and Service Manager; V. G. Vandoren, Assistant Commercial Division Manager; D. K. Banker, Resident Comptroller and Assistant Secretary; F. L. Meacham, Manager, Materials and Process Engineering Division; W. T. Barth, H. J. Wildenhaus, A. C. Donovan, W. V. Richards, H. J. Miller, H. A. Beck, H. E. Schreiber, R. K. Eley, Lon Cooper, P. V. Sprout, N. Potter, A. A. Kucher, M. G. Ellis, D. B. Rhinehart, V. G. Bookout, D. P. Wiesner, G. F. Welber.

ROY E. SMITHSON V. A. HETZEL

THE Question BOX

Readers are invited to send their problems pertaining to the servicing of household refrigerators and small commercial refrigerating equipment as well as oil burners to "The Question Box" which will be answered by competent authorities.

THE following questions submitted to this department are answered by Mr. George H. Clark, chairman National Educational and Examining Board, Refrigeration Service Engineers Society.

Have any readers other opinions regarding the problems involved. Send them to the Editor.

Question 59. On the following problem I would like to have all of the formulas and problems, if possible worked out.

A compressor with a 1½" bore, a 1½" stroke, using methyl, with 350 r.p.m., evaporator temperature 5° F., head pressure 79 lbs., air cooled compressor, running 75% volumetric efficiency.

(a) How many cubic inches are displaced per stroke?

(b) How many cubic inches are displaced per minute?

How much I.M.E. per 24 hours, figuring compressor runs 14 hours?

Also would like to know what size motor it would take for this compressor if line loss is 30%.

ANSWER: To avoid interpolation, we are changing the evaporation temperature to 3° F. and the condensing pressure to approximately 85 lbs. gage pressure, corresponding to an 89° condensing temperature.

The volume displaced per stroke of a compressor is equal to the area of the piston times the length of the stroke times the volumetric efficiency. In the case given with a compressor having a 1½ inch bore, a 1½ inch stroke and 75% volumetric efficiency, the volume displaced per stroke will be 3.14 (pi) times $.75^2 \times 1.5 \times .75$, which is equal to 1.985 cubic inches per stroke. The number of cubic inches displaced per minute will be the number of cubic inches displaced per stroke times the number of strokes per minute, which in the case of a single cylinder compressor is the r.p.m. Thus the cubic inches displaced per minute at 350 r.p.m. is equal to 1.985×350, or is equal to 695 cubic inches per minute.

To find the ice melting equivalent, we find next the cubic feet of refrigerant circulated per hour, which is done by multiplying the cubic inches displaced per minute by 60 minutes per hour, divided by 1728 cubic inches per cubic foot, which gives us 24.1 cubic feet per hour.

If we suppose the methyl chloride to be at 20 lbs. absolute pressure and that it enters the compressor at a temperature of 60° F. (from Page 6 of Bulletin 3, Refrigeration Service Engineer's Society Lecture Course), we find that at 20 lbs. absolute pressure and 60° temperature, the volume per pound of methyl chloride is 5.33 cubic feet. This gives us 24.1 divided by 5.33, or 4.525 lbs. per hour of refrigerant circulating. If the vapor leaves the evaporator in the saturated condition at 20 lbs. absolute pressure, its heat content will be 195.0 B.t.u.'s per lb., as given on Page 6 of Bulletin 3. From Page 5, Bulletin 3, we find the heat content of the liquid entering the expansion valve at 80° is 44.11. The difference, 195.0 — 44.11 equals 150.9 B.t.u.'s per lb. as the refrigeration done. In 14 hours the machine will develop under these conditions $4.525 \times 150.9 \times 14 \div 144$, which equals 66.4 pounds I.M.E.

With respect to the motor size to be used in this machine, I would say that a 1/6th h.p. motor should take care of this machine.

I am not certain what you mean by a "line loss of 30%."

If you want to find the theoretical horsepower requirements of this machine, you can find the entropy and heat content of the saturated vapor at 20 lbs. absolute pressure. The entropy may be found to be .421 and the heat content 195.0 B.t.u.'s per lb.

If we can find where the constant entropy

compression path of the refrigerant leaving the evaporator at 3° meets the super heat curve at the condensing pressure, say 100 lbs. absolute pressure, we find that the vapor leaving the compressor would leave at a temperature of approximately 160°. This heat content would be 227.2 B.t.u.'s per lb. The difference between 227.2 and 195.0 is 32.2 B.t.u.'s per lb. This represents the amount of energy which has been turned into heat in the compressor, and since 778 foot pounds of work is equivalent to 1 B.t.u., and since we have found that we did circulate 4.525 lbs. of refrigerant per hour, we will be not far off in stating that our theoretical h.p. requirement is equal to $4.525 \times 32.2 \times 778 \div 33{,}000$ times 60, which is .05 h.p.

In all probability we would not have a mechanical efficiency of more than 70% and a motor efficiency of more than 50%. Then if we divided .05, our theoretical h.p., by the two efficiencies, $.7 \times .5$, we get an actual horsepower requirement of approximately .155 h.p. This is between 1/6th and 1/7th of 1 h.p.

Question 60. (a) On Page 8 of the December issue there is an article regarding the Welsbach refrigerator. How does the oil from the oil trap return to the crankcase without allowing an equalization of pressures momentarily? I would just like to know how it is constructed so as to allow the oil to pass from the high-side to the low-side.

(b) Why does the liquid line enter the top and suction line leave the bottom of the direct expansion coil such as is advertised on Page 17 of the same issue by the Fedders Mfg. Co.?

ANSWER: (a) The oil trap in the Welsbach refrigerator is in the high pressure part of the compressor. The crankcase is also part of the high pressure part of the compressor, so that the oil trap serves its purpose in keeping the oil from passing into the condenser and circulating with the liquid refrigerant. Some oil actually does circulate with the refrigerant through the condensing coil, the receiver and the expansion valve, into the low side of the system. The suction line from the evaporator returns the oil to the suction side of the compressor. The compressor is made up of two horizontal cylinders, and two pistons, which are built in one piece and moved back and forth by means of a sliding block arrangement. The pistons have no valves in them. The end of each cylinder contains a suction check valve which receives vapor from the suction line and a discharge valve which discharges the high pressure vapor into the crankcase of the compressor through a passageway in the cylinder casting. The compressor seal seals the high pressure vapor in the crankcase from the atmosphere.

(b) With the liquid entering the top of the coil and the vapor leaving the bottom, the warmest air comes into contact with the coldest coil surface. The air passing over the coil is thus dehydrated at the top of the coil, which causes the top of the coil to frost but the bottom does not frost.

During the off period the warm air soon defrosts the top part of the coil, which causes quicker defrosting than when the refrigerant flow through the coil is reversed. When the liquid enters the bottom of the coil it lays in the bottom of the coil during the off period and keeps that part of the coil cold for some time after the machine shuts off and thereby retards defrosting.

Question 61. I have a Majestic Model 101 on which the refrigerant has all leaked out from the unit and I am wondering if you can give me information as to how it can be charged?

ANSWER: The Majestic refrigerator which you want to charge may be charged as follows:

Cut open the low pressure vapor line from the evaporator to the suction side of the compressor, install a line shut off valve in this line by means of flaring the two ends of the tube which has been cut. The refrigerant charge may then be charged in through the side opening of the three way valve.

The refrigerant may be charged in the liquid line in a similar manner by drawing it in from the refrigerant drum in the form of a liquid through the evaporator and into the condensing unit. In general, my experience has been that satisfactory operation cannot be guaranteed with a machine of this type which has lost the refrigerant charge and has been recharged. However, it may be that someone else may have more success.

New Refrigeration Ordinance Proposed for New York City

Some Provisions of Refrigeration Ordinance Covering Every Classification of Equipment.

A NEW city ordinance covering refrigeration installations of every classification has been proposed for the city of New York. If the proposed ordinance is adopted, it will require that any person who installs, services or repairs a refrigerating system of any capacity shall first secure a certificate of qualification from the fire commissioner. Such certificate of qualification shall be issued by the fire commissioner to any person or persons who shall establish satisfactory evidence of his competence by training and experience.

The various systems are classified according to the amount of refrigerant contained, therein, as follows:

Class A Systems containing over 1,000 lbs.

Class B Systems containing 100 to 1,000 lbs.

Class C Systems containing 20 to 100 lbs.

Class D Systems containing 6 to 20 lbs.

Class E Systems containing less than 6 lbs.

Excerpts of the ordinance pertaining to the servicing of domestic and small commercial units are reprinted, herewith.

Article 1—General Provisions

Sec. 1. Definitions:
Unless otherwise expressly stated, whenever used in this chapter the following terms shall respectively be deemed to mean:

33. Refrigerating system: A combination of apparatus in which a refrigerant is or can be circulated for the purpose of extracting heat.

(a) The parts of the system are the compressor, generator, condenser, absorber, receiver, shell type or tube type apparatus, pipes, vessels, or other parts, containing refrigerant.

(b) Direct method of refrigeration: A system in which the evaporator is located in the material or space refrigerated or in air circulating passages communicating with such space.

(c) Direct method of refrigeration: A system in which a liquid, as brine or water, cooled by the refrigerant, is circulated to the material or space refrigerated or is used to cool air so circulated.

(d) Double indirect method of refrigeration: A system in which brine or water cooled by the refrigerant further cools, without direct contact, brine or water which is then circulated to the substance or space to be cooled or is used to cool air so circulated.

(e) Refrigerant is the chemical agent other than brine or water used to produce refrigeration.

(f) Irritant refrigerant: Any refrigerant which when breathed attacks the throat or lungs.

(g) Hydrocarbon refrigerant: Any refrigerant composed exclusively of hydrogen and carbon.

(h) Flammable refrigerant: Any refrigerant which, when mixed with air under the most favorable conditions to support combustion, forms more than a weakly combustible mixture.

(i) Refrigerating machinery room: A room in which is located a refrigerating system containing a refrigerant, but not including evaporators when located in cold storage rooms, refrigerator boxes, or other spaces to be refrigerated.

(j) Pressure imposing element: That apparatus which draws the refrigerant from the low pressure or low temperature side of the system and discharges it into the high pressure or high temperature side of the system.

(k) Pressure limiting device: A pressure or temperature responsive mechanism for automatically stopping the operation of the pressure imposing element.

(l) Brine: Any liquid which having been cooled by the refrigerating system is used for the transmission of heat.

(m) Pressure relief device: A pressure relief valve, a rupture member for relieving the pressure.

(n) Pressure relief valve: A valve held shut by a spring to automatically relieve pressure in excess of its setting.

(o) Rupture member: A device that will automatically rupture at a predetermined pressure.

(p) Liquid receiver: A vessel permanently connected to a system by inlet and outlet pipes for storage of a liquid refrigerant.

(q) Container: A cylinder for the shipment of refrigerant constructed to conform to the regulations of the Interstate Commerce Commission.

(r) Air conditioning: Cooling of air for human comfort and/or for aid in the processing of materials, by means of a refrigerating system.

(s) Evaporator: That part of a system in which refrigerant is expanded or vaporized to produce refrigeration.

(t) Expansion coil: An evaporator constructed of pipe or tubing.

(u) Public buildings, business buildings, and residence buildings are buildings as so defined by Section 70, Article 4, of the Building Code of the City of New York.

NOTE: *Public Buildings:* Public buildings are buildings or parts of buildings in which persons congregate for civic, political, educational, religious or recreational purposes, or in which persons are harbored to receive medical, charitable or other care or treatment, or in which persons are held or detained by reason of public or civic duty, or for correctional purposes, including among others, court houses, schools, colleges, libraries, museums, exhibition buildings, lecture halls, churches, assembly halls, lodge rooms, dance halls, theaters, bath houses, hospitals, asylums, armories, fire houses, police stations, jails, and passenger depots.

NOTE: ***Residence Buildings:*** Residence buildings are buildings or parts of buildings in which sleeping accommodations are provided, except such as may be for other reasons classed as public buildings, including among others, dwellings, tenement houses, hotels, lodging houses, dormitories, convents, and studios, and club houses having sleeping accommodations.

NOTE: ***Business Buildings:*** Business buildings are buildings or parts of buildings, which are not public buildings or residence buildings, including among others office buildings, stores, markets, restaurants, warehouses, freight depots, car barns, stables, garages, factories, laboratories, smoke houses, grain elevators, and coal pockets.

Article 3—Bonds and Fees

Fees for Permits

Applicants for permits under the provisions of this chapter shall pay annual fees as follows:

35. Refrigerating systems:

Class A systems containing over 1,000 lbs.	$20
Class B systems containing 100 to 1,000 lbs.	10
Class C systems containing 20 to 100 lbs.	6
Class D systems containing 6 to 20 lbs.	4
Class E systems containing less than 6 lbs.	1

Article 18—Refrigerating Systems

Sec. 216. Permits and Approvals.

(a) No person shall maintain and/or operate a refrigerating system without a permit.

(b) Exemptions—no permit, however, shall be required to maintain and/or operate a refrigerating system in the residence portion of any building.

(c) No permit shall be issued until the installer has filed satisfactory proof with the Fire Commissioner that the system has been installed in accordance with the requirements of this article.

(d) No refrigerating system shall be maintained or operated employing a refrigerant other than those specified in this article without a permit issued upon such conditions as are deemed by the Fire Commissioner necessary in the interest of public safety.

(e) No refrigerating system shall be installed, serviced, or repaired by any person or persons who have not obtained a certificate of qualification from the Fire Commissioner. Such certificate of qualification shall be issued by the Fire Commissioner to any person or persons who shall establish satisfactory evidence of his competence by training and experience.

Sec. 217. Supervision.

(a) No refrigerating system containing more than 100 lbs. of refrigerant shall be operated in any building except under the personal supervision, direction or control of either a duly licensed engineer or a person who has obtained a certificate of qualification to operate such a system from the Building Department. Where the system contains not more than 200 lbs. of refrigerant and is fully automatic only one qualified operator will be required. An engineer or operator shall not supervise or operate refrigerating equipment in more than one building.

Sec. 218. Classifications.

(a) The total number of pounds of refrigerant common to a system shall be considered the capacity of the system and determine its class, as follows:

Class A systems containing over 1,000 lbs.
Class B systems containing 100 to 1,000 lbs.
Class C systems containing 20 to 100 lbs.
Class D systems containing 6 to 20 lbs.
Class E systems containing less than 6 lbs.

(b) For the purpose of this article, refrigerants shall be classified as non-irritant or irritant, and further as flammable or non-flammable.

Sec. 219. Permissible Locations.

(a) No refrigerating system shall be installed or maintained in or on the stairways, halls, entrances, exits, or auditoriums of any building.

(b) No refrigerant shall be carried throughout any building, or from one building to another, by means of piping, except:

1. When confined in any business building used exclusively for manufacturing, processing or storage, including among others ice making, cold storage warehouses, meat packing, slaughter house, ice cream manufacture, candy manufacture, dairy, fur storage, when not more than 20 people are employed above the first floor in such occupancies.

2. When not carried above the first floor in a business and/or residence building.

3. When confined to the space of any one floor in a business and/or residence building occupied by a single tenant.

4. When confined to the space in a one or two family dwelling occupied by a single tenant.

5. When confined to the roof and top floor of a single occupancy in a business building.

6. When the refrigerant employed is non-irritant and non-flammable.

(c) No refrigerating system employing ammonia or sulphur dioxide may be installed and operated in any building or that part of a building used as a:

1. Theater and/or motion picture theater with seating capacity of more than 50 persons.

2. Hospital and/or asylum where persons are confined and/or helpless.

3. Department store of more than one story, except where the refrigerant is confined in a machinery room located on the roof.

4. Court room, jail, police station, subway, waiting room or public room in a railroad passenger depot or a room opening directly therein, dance hall, or dance hall and cabaret.

5. School or college unless the refrigerating system be of the hermetically sealed approved unit type and contains not more than six lbs. of refrigerant, or unless the system is used exclusively for instruction or research purposes.

6. Exhibition hall such as the Grand Central Palace, Madison Square Garden, or Armory.

7. Public building as so defined by Section 70, Article 4 of the Building Code of the City of New York except as provided in paragraph (c) of this Section.

(d) No refrigerating system employing more than 10 lbs. of irritant and/or flammable refrigerant, other than ammonia or sulphur dioxide, shall be used in any one room in a public building unless:

1. The system or systems are of the unit type hermetically sealed and for which a certificate of approval has been issued by the Fire Commissioner, to the manufacturer, or unless:

TABLE 1

REFRIGERANT	CHEMICAL SYMBOL	CLASSIFIED AS
Ammonia	NH_3	Irritant and non-flammable
Butane	C_4H_{10}	Non-irritant and flammable
Carbon Dioxide	CO_2	Non-irritant and non-flammable
Dichlorodifluoromethane (Freon) (F-12)	CCl_2F_2	Non-irritant and non-flammable*
Dichlorotetrafluoroethane (F-114)	CCl_2F_4	Non-irritant and non-flammable*
Dichloromethane (Methylene Chloride) (Carrene No. 1)	CH_2Cl_2	Non-irritant and non-flammable*
Dichloromonofluoromethane (F-21)	$CHCl_2F$	Non-irritant and non-flammable*
Dichloroethylene	$C_2H_2Cl_2$	Irritant and flammable
Ethane	C_2H_6	Non-irritant and flammable
Ethyl Chloride	C_2H_5Cl	Non-irritant and flammable
Isobutane	$(CH_3)_3CH$	Non-irritant and flammable
Methyl Chloride	CH_3Cl	Irritant and flammable
Methyl Formate	CH_3COOH	Irritant and flammable
Propane	C_3H_8	Non-irritant and flammable
Sulphur Dioxide	SO_2	Irritant and non-flammable
Trichloromonofluoromethane (F-11) (Carrene No. 2)	CCl_3F	Non-irritant and non-flammable*
Trichlorotrifluoroethane (F-113) (Carrene No. 3)	$C_2Cl_2F_3$	Non-irritant and non-flammable*

* Note—Irritant when used in a room in which an unvented flame is present.

2. The entire system or systems are confined in a vapor-proof refrigerating machinery room used for no other purpose and in which no open flame or apparatus to produce an open flame is used.

(e) No brine shall be used in any brine circulating system that will generate flammable vapor at a temperature below 100° F. when tested in a Tagliabue open cup tester, and no irritant and/or flammable refrigerant shall be used as a brine.

(f) Any system employing a hydrocarbon refrigerant in excess of 20 lbs. shall not be installed or maintained in the built-up sections of the city.

Sec. 221. Ventilation.

(a) Each room in which any refrigerating system is used must be provided with means for adequate ventilation to the outer air in accordance with the requirements as set forth in Table No. 2, except spaces through which pipes carrying the refrigerant pass.

TABLE 2

Pounds of refrigerant in system	Mechanical cu. ft. per minute discharge	Mechanical sq. ft. duct area	Window or door area in sq. ft. for one side only
A	B	C	D
up to 20	150	¼	6
50	250	⅓	12
100	400	½	16
150	550	⅔	19
200	680	⅚	25
250	800	1	29
300	900	1	32
400	1,100	1¼	38
500	1,275	1¼	42
600	1,450	1½	45
700	1,630	1½	48
800	1,800	2	51
900	1,950	2	55
1,000	2,050	2	59

(b) If refrigerant piping pass through a room and there be joints located in such room, then the room must be ventilated in accordance with the requirements as set forth in Table No. 2.

Sec. 222. Air Conditioning.

(a) No refrigerating system employing ammonia or sulphur dioxide shall be used for air conditioning in any building.

(b) No refrigerant classified as flammable shall be employed for air conditioning in any building.

(c) Not more than 10 lbs. of a non-irritant and non-flammable refrigerant shall be employed for air conditioning by direct refrigeration method in any one refrigerating system located in any one room in a public building.

(d) If the refrigerant charge in a refrigerating system in a public building exceeds 10 lbs., such system must be of the indirect refrigeration type.

(e) Not more than 200 lbs. of refrigerant shall be employed for air conditioning by the direct refrigeration method in any one system located in a business or residence building.

(f) If the refrigerant charge in a refrigerating system located in a business or residence building exceeds 200 lbs., such a system must be of the indirect refrigeration type.

(g) Brine may be obtained from a system external to a building for use in air conditioning such building provided the double indirect method is used for cooling the brine, in a machinery room, at the point of origin.

Sec. 223. Open Flames and Electrical Equipment.

(a) Systems containing more than 100 lbs. of an irritant or flammable refrigerant shall be equipped with a remote control switch which shall be located immediately outside the machinery room.

(b) Each electrically operated system equipped with relief valve shall be protected by a pressure limiting device, located on the high pressure side of the system, set to stop the pressure imposing element below the setting of the pressure relief device.

(c) Each Class C system shall be provided with either an overload relay or adequate link fuse protection, except when the compartment housing the refrigerating equipment is constructed entirely of fireproof materials as classified by the Building Code or as may be approved by the Fire Commissioner.

Sec. 224. Testing.

(a) Every part of any refrigerating system erected on the premises, except pressure gauges and control mechanism, shall be tested to at least 90 per cent of the safety valve setting. Class A and B systems containing over 100 lbs. of refrigerant shall be tested after installation and proved tight before being operated. A dated declaration of such test, signed by the tester, shall be posted in the machinery room.

Sec. 225. Piping.

(a) No soldering shall be permitted in the joints of refrigerant piping which melts below 1300° F. Soft soldering may be permitted on the *outside* of the joints to prevent refrigerant leakage only.

(b) All piping or vessels containing the refrigerant shall be supported by metal hangers or other fireproof material in a workmanlike manner.

(c) Piping containing a refrigerant shall not be placed in a hall, stairway, elevator or dumbwaiter shaft, except piping may pass across a hallway if there be no joints in the section in the hallway and it be contained in a rigid conduit.

(d) Every system which may be charged after installation shall have the charging connection located on its low pressure side.

(e) Liquid level gauge glasses, except those of the bull's eye type, shall have automatic closing shut-off valves and such glasses shall be adequately protected against injury by slotted metal casings.

Sec. 226. Safety Devices.

(a) All shell type apparatus of more than 4-in. diameter, containing refrigerant in the liquid phase, shall be protected from over pressure by a spring loaded pressure relief valve. This requirement shall not apply to flooded evaporators located in a refrigerator box.

(b) A rupture member may be substituted for the pressure relief valve in carbon dioxide systems or systems normally operating below atmospheric pressure.

(c) No shut off valve shall be located between a pressure relief valve and that part of the system protected thereby, unless two pressure relief valves of required size are used and so arranged that only one pressure relief valve can be cut off for repair purposes at any one time.

(d) The discharge from pressure relief valves, when an irritant refrigerant is used, must be piped to the outside of the building with the outlet orifice turned downward. The discharge from more than one relief valve may be run into a common header, the area of which shall be equal to the area of the pipes connected thereto.

(e) The size of the free diameter for pressure relief valves shall not be less than as follows:

For Class A systems	1 in.
For Class B systems	½ in.
For Class C systems	¼ in.
For Class D systems	¼ in.
For Class E systems	¼ in.

(f) Pressure relief valves shall be placed above the liquid refrigerant level and set to relieve at not more than the values in pounds per square inch as set forth in Table No. 3:

The value in Table No. 3 are the vapor pressures of the refrigerants at 127° F. except for high pressure refrigerants where the values are calculated by multiplying the gauge pressure in pounds per square inch at the critical temperature by the factor 1.5.

TABLE 3

REFRIGERANT	Value in lbs. Per sq. in.
Ammonia	300
Butane	64
Carbon Dioxide	1585
Dichlorodifluoromethane (Freon) (F-12)	173
Dichlorotetrafluoroethane (F-114)	52
Dichloromethane (Methylene Chloride) (Carrene No. 1)	8
Dichloromonofluoromethane (F-21)	45
Dichloroethylene	0.5
Ethane	1075
Ethyl Chloride	39
Isobutane	93
Methyl Chloride	155
Methyl Formate	15
Propane	240
Sulphur Dioxide (Esotoo)	116
Trichloromonofluoromethane (F-11) (Carrene No. 2)	23
Trichlorotrifluoroethane (F-113) (Carrene No. 3)	2

(g) Where rupture members are permitted and used, the equivalent area of the relief valve specified must be provided.

2. Signs

(a) Each refrigerating system shall be provided with an easily legible metal sign permanently attached and easily accessible, giving the kind and total number of pounds of refrigerant contained in the system.

(b) Systems containing more than 100 lbs. of refrigerant shall be provided with metal signs having letters of not less than ½ in. in height designating the main shut off valves to each vessel, main steam or electrical control, remote control switch, pressure limiting device, and on all exposed high pressure and low pressure piping in each room where carried outside the machinery room.

(c) Each pressure relief valve shall be labeled by an easily legible permanent tag designating its setting in pounds per square inch.

3. Storage of Refrigerant

(b) No refrigerant other than that employed in the system shall be stored in a Class C machinery room.

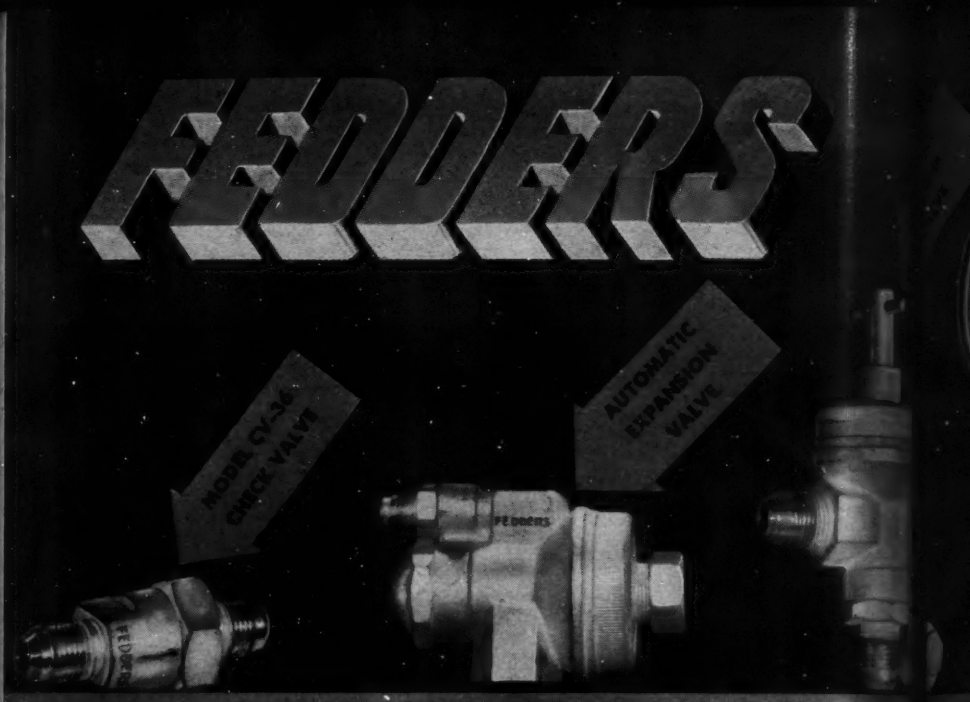
(c) Irritant and/or flammable refrigerants in excess of that permitted in the machinery room shall be stored in a fireproof shed or room used for no other purpose.

(d) Refrigerants withdrawn from systems shall be transferred to containers as prescribed by the regulations of the Interstate Commerce Commission for the transportation of such refrigerant. No refrigerant shall be discharged to a sewer or to the open air except through pressure relief valves.

(e) No container shall be left connected to a system except while charging or withdrawing.

HERKIMER INSTITUTE OFFERS OIL BURNER COURSE

THE Herkimer Institute of Mechanical Trades, New York City, in addition to their refrigeration courses offer training in oil burner servicing. This is, of course, in line with the trend of the larger refrigerator manufacturers who have now entered the oil burner manufacturing business. The close relation of refrigeration and heating offers possibility for the service engineer in the development of his business.



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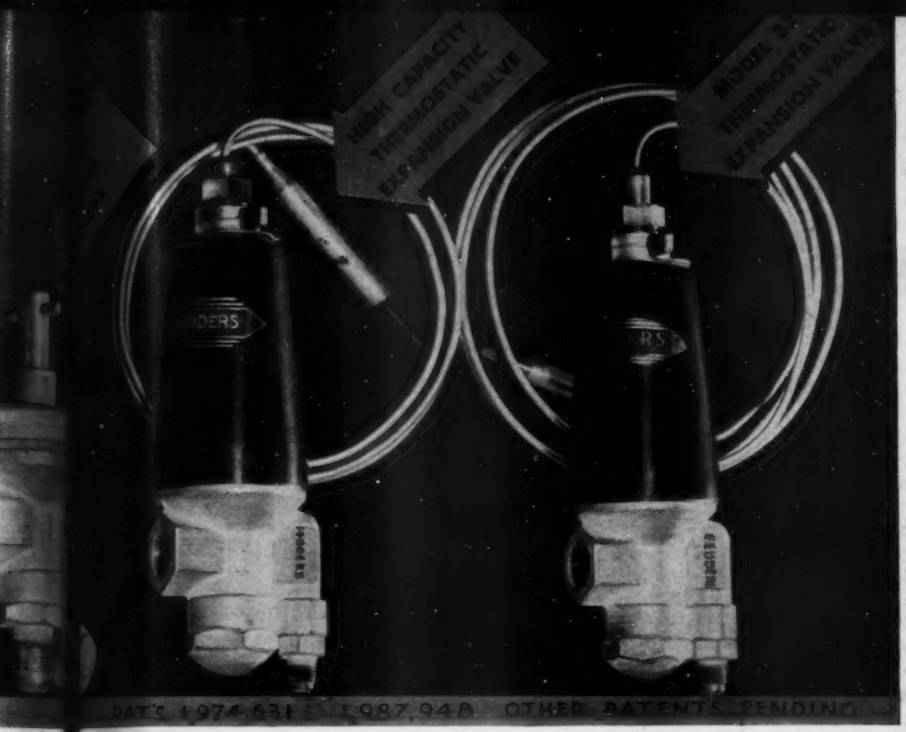

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ARE YOU GETTING YOUR COPY OF THE FEDDERS NEWS?

NEW CONTROL DEVICE FOR HERMETIC COMPRESSORS

AT the recent annual meeting of the American Society of Refrigerating Engineers, Frank H. Steining of the faculty of the University of Pittsburgh, described a device which he had developed for use with a Majestic hermetically-sealed refrigerator, and which he stated offered possibilities for other hermetic machines in which the compressor dome is subjected to high pressure gases. "It has been found," he stated, "that when the high pressure gas strikes the dome, condensation occurs and then is likely to drain to the oil sump in the base of the compressor and as a consequence, the refrigerant may be forced into the bearing surfaces rather than the oil, causing such conditions as inefficient lubrication, compressor inefficiency, noisy operation, etc. Manufacturers have been working on the problem of overcoming this condensation and the use of the heating element has been employed in some machines, which is usually in the base of the compressor assembly submerged below the oil sump." The speaker stated that there are some drawbacks to this arrangement which affects the efficiency of the compressor.

Other attempts to overcome this difficulty include covering the dome so that sufficient heat can be retained in the dome proper during the off cycle period. This method also, he stated, had disadvantages particularly in cold weather and does not satisfactorily overcome the condition. His device, as he explained it, comprises a high side float control, which is built into the base of the compressor and through the density differences of the refrigerant and oil will direct the oil and refrigerant to their places.

With Mr. Steining's system, the condensate is returned to the base of the machine and as with the conventional high side float is again returned to the evaporator. Further, he stated that it may be possible to eliminate external condensing coiling by providing surface on the dome which would act as the condenser. As to the operation of his control, the difference in specific weight of SO_2 and the mineral oil lubricant is used so that the float will sink when submerged in the oil blanket, but will float in the denser mixture of sulphur dioxide and oil in the device.

FEDDERS FACTORY BRANCH OPENS IN NEW YORK CITY

TO provide additional facilities and close factory engineering contact both to the electric refrigeration and automotive radiator trades throughout the east, a new Fedders Factory Branch has been opened at 106 East 19th St., New York.

FRANK HAAG.

Frank Haag, formerly branch manager at Cincinnati, is in charge of the New York branch. Mr. Haag has had long experience in the experimental and engineering departments at the factory.

A large stock of Fedders standard refrigeration appliances and automotive radiator cores is being carried at this branch for distribution. Melchior, Armstrong, Dessau Co., continue to represent Fedders from their New York, Boston and Philadelphia offices.

\$ \$ \$

SERVICE TIP

MOST service men are acquainted with the method of "balancing the pressure" in pumping down a unit. This consists of "cracking" the shut-off valve on the receiver and allowing a small amount of refrigerant in the lines so that the pressure is slightly above atmospheric when they break the connections.

Another worthwhile precaution is to purge the liquid and suction lines as well as the evaporator after making the connections. This is done by "cracking" the flared nut in the suction line at the suction side of the compressor after allowing a small amount of refrigerant to enter the lowside.—*Fedders News.*

METAL TEMPERATURE PRESSURE SCALE

A TEMPERATURE pressure scale is an important part of every service man's kit. However, the objection is that most printed scales find a short life in the average service man's notebook or his service kit.

A new scale etched on metal, which is convenient for vest pocket use, measuring approximately 2" wide by 6", has been published by Mr. P. F. Ford, of the Greer College of Refrigeration and Air Conditioning, Chicago, and includes all of the refrigerants in common use today. The scale is fitted into a convenient case, and is most legible.

IMPORTANCE OF DOOR GASKETS IN REFRIGERATION

By H. W. JARROW

DOOR gaskets in refrigeration have been in general use only for the past fifteen years. Before that a few commercial manufacturers used door gaskets, but most manufacturers depended on a well fitting door which was efficient until either the door or the frame warped slightly, when there was an infiltration of warm air from the outside, which reduced the efficiency of the cooling room. It was then found necessary to use some method to block this infiltration and gasketing of the door became a common practice. This was then taken up by the manufacturer of household refrigerators.

As the industry progressed, in larger installations two and three layers of door gaskets were used and are being used. That these gaskets are necessary is shown by tests which the writer has made.

In testing a large cooling room with gaskets which were worn and had not been replaced as they should have been, the following results were obtained: Over a period of 72 hours, outside mean temperature 70.8 degrees; inside mean temperature 38.2 degrees; the door being opened in this period 368 times. The gaskets were then replaced with new gaskets of the proper size and the cabinet again tested for another 72 hour period, with the following results: Outside mean temperature 70.2 degrees; inside 33.9 degrees; door openings 401.

The difference in current used under these conditions being 14% less, and maintaining a lower inside temperature. Had the same temperature been maintained in both instances the saving in current would have approximated 30%. In many cases where a household compressor is running an abnormal length of time regasketing the doors will help better this condition.

Door gaskets today are of two types, the rubberized fabric and the all rubber type. It is a known fact that the rubberized fabric offers greater resistance to heat conduction than the all rubber, but manufacturers of household refrigerators can afford to neglect the slight difference in efficiency here in order to make a better appeal to the eye, which the all rubber does over the rubberized fabric, the difference in the average six cubic foot household refrigerator being about 4% in current consumption. It is for this reason that it is recommended on household refrigerators that the gaskets be replaced with the all rubber while on the commercial installations where current consumption is an item it is recommended that the rubberized fabric be given preference.

In this connection the test recently made on a seven cubic foot household refrigerator with all rubber gaskets which had not been replaced in a matter of 3½ years probably would be of interest to our readers. The gasket was in fair condition only. It had softened up at the top of the door and also on the opening side where the hand had come in contact directly with the gasket in opening and closing the door. A recording thermometer was placed inside the refrigerator on the middle shelf and a recording meter was placed on the current line. Readings were taken showing an average temperature of 49.2 degrees with the compressor running about 90% of the time. The gaskets were then replaced and readings taken for a like period with the mean temperature on the middle shelf being maintained at 46.1 and the compressor running approximately 40%. The saving in current in this instance was half. Outside mean temperatures were not taken into account inasmuch as the refrigerator was in a pantry with the kitchen temperature fairly constant.

Refrigeration Controls

(CONTINUED FROM THE JANUARY ISSUE)

In this Concluding Article, the Author Continues the Description of Various Air Conditioning Controls

By L. B. MILLER *

IT is a well known fact that in cooling, the function of dehumidification or the extraction of water is much more costly than the elimination of sensible heat or sensible cooling, the ratio being that of the number of B.t.u.'s of specific heat against the number of B.t.u.'s of latent heat of vaporization of the moisture which must be removed in the process. Furthermore, in using direct expansion coils, lower coil temperatures must be maintained to reduce the dew point and thereby extract the moisture while higher coil temperatures may be employed to accomplish the sensible cooling. This results in respectively low and high back pressures, which in turn naturally determine the refrigerating capacity of the machine. Consequently, if the mechanical equipment in the system itself is so arranged that sensible and latent cooling may be figuratively obtained as separate functions, a control system which will call upon sensible cooling first and latent cooling or dehumidification only when excessive humidities are the result, would certainly indicate economy of the first order.

It would also naturally follow that even without these provisions a control system accomplishing this regulation in the same manner should not only give satisfactory operating characteristics but also a certain degree of economy. This, then, is the reason for the Compensated Effective Temperature Control.

Modulating Action. This control system may be applied to the so-called bypass system for controlling reheating through the bypass of return air or may be used for modulating mixing valves to in turn control the temperatures of water in the so-called spray system. It will be observed that a third factor has been introduced into the hookup, that of relative humidity.

Figure 7 shows a schematic diagram of the system comprising an outdoor temperature compensator, an indoor relative humidity compensator and an indoor temperature controller, which are electrically connected to control the operation of the standard Modutrol motor. Briefly, the method of operation is that the outside temperature controller determines the inside effective temperature, of which the relative humidity is permitted to vary any place within the comfort zone, that is between 60% and 30%, and in turn to measure the value of dry bulb temperature on the inside at which the system is to control. The outdoor compensator is of conventional potentiometer type, the indoor relative humidity compensator is also of the potentiometer type.

Controllers Have Wide Differentials

In this case all controllers are provided with wide differentials. The outside compensator has a range of from 75° to 100°, with a differential of 25° equivalent to the total range. This means that when the outside temperature is at 75° the slide wire will be at one limit of the resistance, and when the outside temperature is at 100° the slide contact is at the other end of the resistance. Likewise the humidity compensator has a range and differential of 30%, the high limit being 60% relative humidity and the low limit being 30%. The inside temperature controller has a differential and range of 10°, its low limit being 72° and its high limit being 82°.

Again, referring to the table of temperatures it will be seen that we have extended the top limit of outside dry bulb temperatures to 100°, which in turn would raise the top limit of inside dry bulb to 82° approximately and a corresponding effective temperature of 74°. It will be seen therefore, insofar as inside dry bulb and inside relative humidity are concerned, we have bounded by the differentials of the respective controllers the limits of the summer comfort zone. The

* Refrigeration Division, Minneapolis-Honeywell Regulator Co.

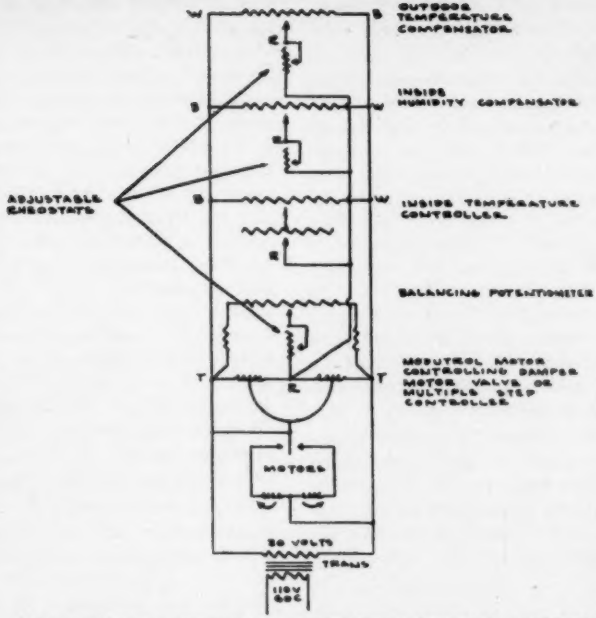

FIG. 7. COMPENSATED, EFFECTIVE TEMPERATURE CONTROL. MODULATING.

result of this is an attempt to control from a zone rather than from a fixed set of conditions similar to a certain dry bulb, wet bulb, or relative humidity, and to thereby not only obtain entirely satisfactory results from a comfort standpoint, but also enhance the economy of operation.

It must be borne in mind that the fundamental basis of this type of regulation is predicated on the accuracy of the psychometric chart, but it also should be remembered that the system is so flexible that it may be readily adjusted to any set of conditions that may pertain to any particular installation.

Assume the following set of conditions, outside dry bulb 85° which will give an inside dry bulb of 76.5°, or an effective temperature of 71°. With this outside dry bulb, the outdoor temperature compensator immediately determines an effective temperature indoors of 71°. Assume at this instance that the inside relative humidity is 50%. The inside humidity compensator immediately measures this amount of relative humidity and establishes a dry bulb temperature control point of 75°. Should the inside relative humidity be 40%, then the inside dry bulb control point would be 77.5°. Likewise, if the inside relative humidity be 60%, then the inside dry bulb control point would be 75°.

Should the outside dry bulb rise, a higher indoor effective temperature will be determined, under which the relative humidity controller will measure the relative humidity and in turn establish the dry bulb control point. It will be seen from this that in reality we are controlling from a zone rather than from a fixed set of conditions, inasmuch as we are permitting both the dry bulb and relative humidities to vary, but at the same time keeping both of these factors within the limits of the comfort zone.

Control of "On and Off" Loads. In the foregoing we outlined the operation of Compensated Effective Temperature Control with modulating action which might be used for the proportioning of dampers or valves. This same control may be translated into

two position control to regulate the operation of compressors, solenoid valves and similar equipment.

Figure No. 8 shows the schematic wiring diagram of this system and in view of foregoing explanations, should be self-explanatory. In this control setup the Modutrol motor is replaced with the balancing relay which translates or in reality integrates the specific functions of the three controllers into a final on and off action, which in turn may regulate the equipment to be controlled.

In these two latter control systems, the function of the external adjustable rheostats is to fix the control differential of any three of the controllers within any desired limit. This should indicate again the extreme flexibility of the system.

Should the mechanical equipment be provided with means for separating sensible from latent cooling, the relative humidity compensator may be equipped with an auxiliary contact which is adjustable and set to any maximum value of relative humidities desired, 60% relative humidity of course being the top limit of the comfort zone. With a system so equipped, whenever cooling is demanded, sensible cooling is called upon first. Here the maximum refrigeration capacity is obtainable from the machine and, if this satisfies control conditions, the equipment will operate in this manner. However, should the relative humidity for any reason, such as extraneous loads, have a tendency to rise; when its value reaches the top limit for which the auxiliary contact on the humidity controller is set, it will immediately call into action the dehumidification means. Through this sequence of operation it will be seen that as much cooling as possible is done in removing the sensible heat and that dehumidification or latent cooling is only called into operation when excessive relative humidities obtain. A definite measure of economy of operation is obviously apparent.

Possibly the best angle in which to view the operation of this control system is that of establishing an electrical balance between

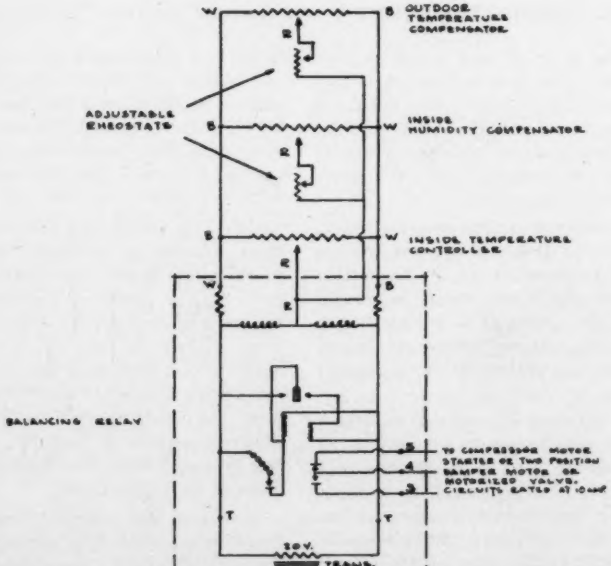

FIG. 8. COMPENSATED EFFECTIVE TEMPERATURE CONTROL. TWO POSITION CONTROL.

prime factors which are electrically correlated in the circuit in accordance with their relative values or weights. With an inside effective temperature determined by the outdoor compensator, any change in inside dry bulb temperature or inside relative humidity displaces this balance and calls for operation of the control means in accordance with the character of the displacement, that is whether it is dry bulb or relative humidity. From the very nature of the system it should be apparent that the prime factors need not be limited to three controllers but may be increased to a greater number of controllers should the character of the problem demand.

There is one more feature that has been developed in connection with this system and that is the control of multiple compressors. The trend seems to be towards the employment of a group of smaller units rather than that of one large refrigeration unit to effect the cooling. This permits a program of operation of a small unit bringing them on or shutting them off with changes in load conditions. For this operation we have developed a program or sequence switch which consists of a group of individual switches for controlling individual compressors or various speeds on multispeed motors driving compressors, which are operated by cams adjustably arranged on a shaft directly driven by a Modutrol motor. The controller for this motor may be a temperature control or what not, which will maintain a sequence of operation of the compressors in close accordance with the changes in load conditions and thereby still further enhance the operating economy of the installation.

Heating Cycle. At the beginning of the description of the Modutrol Control System, it was mentioned that the discussion would be confined entirely to the cooling cycle. Since the flexibility of the system can now be appreciated, it is readily apparent that it may be applied to the heating cycle with equal success. However, conditions in the heating cycle are somewhat different.

Here relative humidity is the limiting factor for consideration. Building construction and glass exposure limit the maximum relative humidity that may be carried with low outside temperatures. Therefore the outside compensator in determining the inside effective temperature must reduce the relative humidity with drop in outside temperature to maintain a dew point below which a condensation on windows and walls will take place. This naturally will lower the effective temperature.

In order then to reposition the effective temperature it is necessary to employ another outside compensator which will measure the inside dry bulb temperature, raising it with a drop in outside temperature and vice versa, to maintain the effective temperature within the comfort zone for heating.

If for no other reason, it is hoped that the foregoing description has indicated the scope and flexibility of this system of control. Undoubtedly the solution of several difficult control problems has already suggested itself to you. Insofar as our company is concerned, each day we are finding new applications and are realizing more and more that we have not by any means exhausted the possibilities of this novel system of control.

S S S

Portland, Ore.—M. E. Shepler has engaged in the refrigeration service business under the name of T. F. Shepler & Son, at 5537 N. Burrage Ave.

A. L. Kirby
Texas

Of all the magazines that I have ever taken or read, I have received more information and help along my line of work from the "Service Engineer" than any. Wishing you all the success with this magazine.

George A. Tiedt,
Ohio.

Please find enclosed check for $2.00 for my renewal to the REFRIGERATION SERVICE ENGINEER. I do not want to miss an issue of its valuable information.

H. Harke
Germany

I take this opportunity to thank you for the prompt mailing of the monthly issues of "THE REFRIGERATION SERVICE ENGINEER." I enjoy reading them very much. Besides being interesting and instructive they keep me informed of the activities in the refrigeration field in the good old U. S. A.

NEW PARTS CATALOG

A STANDARD line of refrigeration appliances which have been designated as "Blue Ribbon Products," is illustrated in a new fifty-page catalog just released from press by the American Injector Company, Detroit, Michigan, with which the Riley Engineering Corporation is associated.

The catalog is attractively printed and is profusely illustrated. The products manufactured include a wide range for many refrigeration applications. Included in the various items illustrated among others is the floating expansion valve, thermostatic expansion valve, high side floats, oil separators, pressure control water regulating valves, automatic suction pressure throttling valves, soft seat packless valves, two-temperature valves, refrigerating valves of many styles, liquid line filters, dehydrators and neutralizers.

Included, also, are new designs in service tools including the flaring tool, tube cutter, pinchoff tool, reseating, rethreading and refacing tools, as well as tube benders and wrenches.

Several pages are devoted to shaft seals, bearing metals and parts, and bellows.

MAINTENANCE AND SERVICE CONTRACTS

IN past issues of THE REFRIGERATION SERVICE ENGINEER, several suggested forms of maintenance and service contracts have been illustrated.

Mr. Harry Drownes, secretary of the Refrigeration Service and Installation Company of Chicago, is responsible for the contribution of the three following forms. Mr. Drownes' company, as one of the largest service and installation companies, has made a thorough study of the type of maintenance contract that would appeal to the purchaser of this type of service.

In a recent interview, Mr. Drownes said, "From his experience, the average maintenance and service contract involved too many 'whereins' and 'whereifs' and as a consequence, was rather confusing to the customer, and might in some instances deter him from entering into such an agreement." He further stated, "After all, the customer must have the utmost confidence in the service company with which he is doing business, and after several attempts at compiling suitable forms, we have come to the conclusion that the simpler and more understandable

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REFRIGERATION SERVICE CONTRACT ON HOUSEHOLD UNITS
⅛ to ¼ Horse Power

The REFRIGERATION SERVICE & INSTALLATION Co., 122 West Illinois St., in consideration of $..... paid at the time of acceptance of this contract, and of $..... payable monthly for eleven months beginning the first payment on ..... herewith enters into a Refrigeration Maintenance Contract with:

NAME .....
ADDRESS .....

to serve under Class ..... Rates the following Household Equipment for a period of one year:

.....
.....
.....

This contract becomes void, when any monthly payment is delinquent for a period of ten (10) days.

ACCEPTED
.....
REFRIGERATION SERVICE & INSTALLATION CO.
BY .....
Date of Acceptance.....

* * * * * * * * * * * * * * *

	Initial Payment on Acceptance of Contract	Monthly Payment for 11 Months	Total Annual Service Charge
CLASS "A" SERVICE RATES Covers all service labor, material and shop overhaul, or replacements of any or all parts to maintain refrigeration, providing repairs and adjustments are necessitated by natural wear and tear.			
EACH APARTMENT	$.....	$.....	$.....
CLASS "B" SERVICE RATES Covers service labor only on all repairs and adjustments necessitated by wear and tear.			
EACH APARTMENT	$.....	$.....	$.....

NOTE: 5% discount will be allowed on yearly payment in full.
Above prices will be reduced on a graduated basis, depending on the number of apartments.
.....This contract is subject to an inspection of the equipment.....

the agreement, the quicker the customer is inclined to enter such an arrangement. Such an agreement should be a plain statement of facts as to what the obligations of the service company and the customer are, and I believe that the three forms which we have adopted, answer this question.

"It will be observed that the three contracts cover specific classifications of work; namely, the multiple, the commercial covering ½ to 2 hp., and the household, which includes ⅛ to ¼ hp."

COMMERCIAL REFRIGERATION SERVICE CONTRACT
on ½ HP to 2 HP Compressors

The REFRIGERATION SERVICE & INSTALLATION Co., 122 W. Illinois St., in consideration of $..... paid at the time of acceptance of this contract, and of $..... payable monthly for eleven months beginning the first payment on ..... herewith enters into a Refrigeration Maintenance Contract with:

NAME .....

ADDRESS .....

to service under Class ..... Rates the following Commercial Equipment for a period of one year:

.....

.....

.....

This contract becomes void, when any monthly payment is delinquent for a period of ten (10) days.

ACCEPTED

.....

REFRIGERATION SERVICE & INSTALLATION CO.

BY .....

Date of Acceptance.....

* * * * * * * * * * * * * * *

	Initial Payment on Acceptance of Contract	Monthly Payment for 11 Months	Total Annual Service Charge
CLASS "A" SERVICE RATES Covers all service labor, material and shop overhaul, or replacements of any or all parts to maintain refrigeration, providing repairs and adjustments are necessitated by natural wear and tear.			
EACH COMPRESSOR AND MOTOR.....	$.....	$.....	$.....
EACH COIL			
CLASS "B" SERVICE RATES Covers service labor only on all repairs and adjustments necessitated by wear and tear.			
EACH COMPRESSOR AND MOTOR.....	$.....	$.....	$.....
EACH COIL			

NOTE: 5% discount will be allowed on yearly payment in full.

.....This contract is subject to an inspection of the equipment.....

REFRIGERATION SERVICE CONTRACT ON MULTIPLE SYSTEMS

The REFRIGERATION SERVICE & INSTALLATION Co., 122 W. Illinois St., in consideration of $..... paid at the time of acceptance of this contract, and of $..... payable monthly for eleven months beginning the first payment on ..... herewith enters into a Refrigeration Maintenance Contract with:

NAME .....

ADDRESS .....

to service under Class ..... Rates the following Equipment for a period of one year:

.....

.....

.....

This contract becomes void, when any monthly payment is delinquent for a period of ten (10) days.

ACCEPTED

.....

REFRIGERATION SERVICE & INSTALLATION CO.

BY .....

Date of Acceptance.....

* * * * * * * * * * * * * * *

	Initial Payment on Acceptance of Contract	Monthly Payment for 11 Months	Total Annual Service Charge
CLASS "A" SERVICE RATES Covers all service labor, material and shop overhaul, or replacements of any or all parts to maintain refrigeration, providing repairs and adjustments are necessitated by natural wear and tear.			
EACH COMPRESSOR AND MOTOR (½-2HP).....	$.....	$.....	$.....
EACH APARTMENT			
CLASS "B" SERVICE RATES Covers service labor only on all repairs and adjustments necessitated by wear and tear.			
EACH COMPRESSOR AND MOTOR (½-2HP).....	$.....	$.....	$.....
EACH APARTMENT			

NOTE: 5% discount will be allowed on yearly payment in full.

Above prices will be reduced on a graduated basis, depending on the number of apartments.

.....This contract is subject to an inspection of the equipment.....

The REFRIGERATION SERVICE ENGINEER

A Monthly Illustrated Journal, Devoted to the Interests of the Engineer Servicing Refrigeration Units, Oil Burners and other Household Equipment.

Vol. 3 February, 1935 No. 2

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Official Organ
REFRIGERATION SERVICE ENGINEERS' SOCIETY

MANUFACTURER CONSIDERS SERVICE MAN IN DESIGNING UNIT

OF considerable interest to the servicing profession, particularly those who identify themselves as independent service organizations, is the recent announcement of a refrigerator manufacturer that the unit has been redesigned so that it may be serviced in the field. This is a particularly important announcement in view of the fact that formerly the design of the unit precluded field servicing, but required a factory exchange if any trouble developed.

In 1934, service valves were installed on the unit so as the compressor and motor might be removed without disturbing the balance of the equipment. This resulted in a most favorable response from servicing organizations, and determined the company's policy for 1935 in adopting a conventional, reciprocating belt-driven machine. The company in making this important change, did so with the express purpose of securing the cooperation of independent service companies, and to further the efficient servicing of their unit when required. A market analysis by this company disclosed that a large percentage of its unsold market still remains in the smaller communities as well as rural districts. To properly service the sealed units subjected the dealer to unnecessary expense in requiring him to maintain a number of replacement units, when most service calls could be economically and promptly serviced in the field.

This attitude of a responsible manufacturer will be good news to service men. It demonstrates again the importance of the refrigeration servicing profession. It is a recognition of the service man as a vital link in the manufacture and selling of refrigerators. Then, again, this may be in the minds of other manufacturers who have added conventional design compressor units in their lines.

To sum it all up, service organizations on the whole are most desirous of cooperating in every way with the manufacturer and a better understanding will advance the best interests of all.

SYSTEMATIZED SERVICING

AGAIN Spring forecasts the season of increased service calls.

Refrigeration servicing is concerned with the element of time. The more service calls per day the greater the opportunity for increased profit. There is only one answer to increase productive labor—systematize your work.

Lost motion costs the service man money, whether employed or operating for himself. There are certain lines of procedure to follow in diagnosing trouble.

Trouble charts published in past issues of THE REFRIGERATION SERVICE ENGINEER have outlined the procedure in locating troubles. No matter how experienced the service man he may secure some pointers from a study of these charts.

T. B. Welch
Massachusetts

I am enclosing a postal money order for $3.00 for a renewal of my subscription to THE REFRIGERATION SERVICE ENGINEER and a binder for the magazines.

My appreciation grows with each issue of your fine publication and I am looking forward with great pleasure to my second year as a subscriber.

REFRIGERATION SERVICE ENGINEERS' SOCIETY

Official Announcements of the activities of the National Society and Local Chapters appear in this department as well as articles pertaining to the educational work of the Society.

THE OBJECTS OF THE SOCIETY

To further the education and elevation of its members in the art and science of refrigeration engineering; with special reference to servicing and installation of domestic and small commercial equipment; for the reading and discussion of appropriate papers and lectures; the preparation and distribution among the membership of useful and practical information concerning the design, construction, operation and servicing of refrigerating machinery.

ASSOCIATION HEADQUARTERS: 433-435 North Waller Ave., CHICAGO, ILL.

SECOND ANNUAL CONVENTION DATES ANNOUNCED

By action of the Board of Directors of the Refrigeration Service Engineers' Society at the last annual convention, Detroit was selected as the city for the holding of the Second Annual Convention.

By further action of the Board of Directors, the dates have been announced, which will be October 24, 25 and 26. Further announcement as to the selection of the hotel and contemplated manufacturers' exhibit will be forthcoming shortly.

COST RECORDS COMMITTEE TO SUBMIT REPORT SOON

THE Cost Records Committee of the Refrigeration Service Engineers' Society has held several preliminary meetings in collaboration with their consulting cost accountant, Mr. J. B. Cook, to consider uniform cost records and forms for the use of members of the Society.

This Committee has suggested several changes in the forms submitted, and it is expected that formal action will be taken on revised forms to be ready in the near future.

MEMBERSHIP CERTIFICATE

THE Refrigeration Service Engineers' Society this year will issue to its members a certificate showing membership in the organization, suitable for framing for the office, service shop or home.

This certificate is to be issued in addition to the membership card, and the number appearing thereon will correspond with the individual membership number.

The actual size of the certificate is 8½" x 11", and will be renewed each year upon payment of the current year's dues.

Members-at-large will receive their membership certificate direct from the National Secretary's office, and local chapter members will secure their certificate through their local secretary.

AKRON CHAPTER

Meeting of January 24

AKRON Chapter held its meeting at 876 S. Main Street, on January 4, with Mr. Claude L. Wall presiding as temporary President, and Mr. Charles Hall as temporary Secretary.

This meeting was held for the purpose of the election of permanent officers. For the

MEMBERSHIP CERTIFICATE ISSUED TO MEMBERS FOR 1935.

The MAN who had a BOOK

YOU laugh at the man who said he did not need a book because he had one. But how about you? Have you stopped adding to your knowledge because you have one diploma? Do you think your education is finished?

S S S

Suppose you are a high school graduate. That training was only a foundation.

S S S

Suppose you do have a College Degree—or several of them. New inventions, new techniques, new points of view, new experiences are continually changing the business world in which you work and the Society in which you live. Your technical training, however adequate it once was, needs continual extension and adjustment.

S S S

Technical training is never finished. Don't wait for some painful or expensive experience to drive this truth home.

INVEST YOUR TIME IN EDUCATION

To make those hours after five good as gold, choose your school, your refrigeration newspaper and your engineering society with care.

HERKIMER INSTITUTE

(Makers of All Make Service Engineers)

1819 Broadway, New York City

Announces advanced service engineering courses in

REFRIGERATION AIR CONDITIONING

OIL HEAT AND BURNERS

HERKIMER INSTITUTE
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I am interested in one of the following courses: .....

☐ Air Conditioning ☐ Refrigeration ☐ Oil Burners

Send me without cost or obligation further information.

Name .....

Address .....

.....

(All correspondence held in strictest confidence and no salesman will call on you.)

office of President, Mr. Wall was nominated and the Secretary instructed to cast a unanimous ballot for Mr. Wall as President for 1935. Richard T. Brett was nominated for First Vice President and unanimously elected. W. Lee Barnaby was elected Second Vice President. Mr. Charles Hall was elected permanent Secretary, and continues in the office which he had served as temporary Secretary. For Sergeant-at-Arms, Mr. Joe Flowers was elected.

The Board of Directors for the ensuing year consists of Messrs. G. W. Stewart, Loy W. Westfall, J. W. Crisp, H. C. Kinsinger and Leo A. Price. For local Chairman of the Educational and Examining Board, Leo Price was elected.

The meeting nights for Akron Chapter were selected for the first and third Thursdays of each month at 7:30 P. M.

* * *

K. D. Small,
Louisiana.

Here's my renewal for the R. S. E. Haven't missed an issue and don't intend to.

CHICAGO CHAPTER CHATTER

By HERMAN GOLDBERG

HEAR ye! Hear ye! Chicago Chapter now boasts of a Scribe! This latest acquisition to Chicago Chapter is the result of President Jacobsen's appointment.

And now to my quill pen and a few pointed paragraphs.

—This column will be conducted in the spirit of friendly gossip and spicy scandal pertaining to our Chicago members, and, occasionally, some of the out-of-towners.

—For instance: It would be interesting to publish the name of the Oak Park refrigeration man who is still passing out cards that he does all kinds of refrigeration service work and also sells Christmas trees at reasonable prices.

—It might also interest a lot of the boys to learn that Bert Maynard was just recently married. This last, of course, is strictly confidential.

—And above all, it would be highly educational to learn the exact words John North-

cote used when he drove up to his store and found the plate glass window was cracked; also at the same time cracking that brand new printed sign. Tom Fowler, the other half of the partnership, probably said "Heck," but what *did* John say?

—As a personal message, I warn others to stay away from Fred Roth's wine kegs when they visit him. Boy, how that stuff can unhinge a fellow's tongue! (Incidentally, Fred has everything from extensive technical recorders and complete massive refrigeration systems down to electric wiener roasters, canned goods and chewing gum.)

—That will be enough for this issue, and as an introduction, but I warn all you "guys" that unless you send in to me scandal about each other, I will use my own personal knowledge. So send your news to me at 5101 W. Madison St., or phone me any time during the day at Austin 6343, and we'll see that you get proper credit for it (if you have "intestinal fortitude" enough to ask for credit).

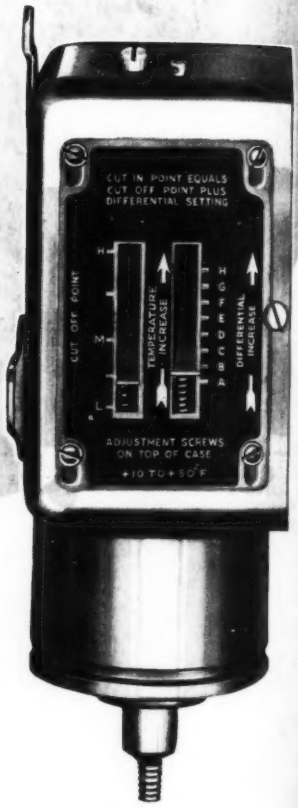
* * *

ARTIC SERVICE NEWS

ARTIC SERVICE NEWS is a new bulletin by the R. & H. Chemicals Department of E. I. du Pont de Nemours & Company, Wilmington, Delaware, and is being mailed to service men.

The bulletin will be issued periodically throughout the year, and future editions will contain articles and items on Artic service problems, such as drying, lubrication, transferring, etc., as well as information on new refrigeration units using Artic as the refrigerant.

Accurate adjustment, quick and simple installation ..... less servicing



VISIBLE SCALES are standard equipment on Minneapolis-Honeywell Refrigeration Controls. They eliminate the hit or miss method of adjustment, as with ordinary controls, and save untold time in service and installation. Locking devices and mercury switches are other features which make the Minneapolis-Honeywell lines superior, yet these controls cost no more. For performance, economy and durability, specify Minneapolis-Honeywell Refrigeration Controls. Minneapolis-Honeywell Regulator Co., 2934 Fourth Ave. So., Minneapolis, Minnesota.

■

MINNEAPOLIS-HONEYWELL

CONTROL SYSTEMS

QUALITY CONTROLS COST LESS THAN SERVIC